

This problem will be collected in class on Dec 7.

1. Show that for a heliumlike ion

$$B^{(1)} = \frac{8}{3} \int_0^\infty dr_1 P_{1s}(r_1) Q_{1s}(r_1) \int_0^\infty dr_2 \frac{r_<}{r_>^2} P_{1s}(r_2) Q_{1s}(r_2),$$

where $P_{1s}(r)$ and $Q_{1s}(r)$ are radial Dirac wave functions.

2. Set $Z = 10$ and assume that the $1s$ wave functions for a heliumlike ion can be approximated by Dirac Coulomb wave functions with $Z \rightarrow Z - 5/16$. Evaluate $B^{(1)}$ numerically and compare with the value given in the notes.